# Articulation and Phonology: Inextricable Constructs in Speech Pathology

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*For many speech-language pathologists, the application of the concepts of phonology to the assessment and treatment of phonologically disordered children has produced more confusion than clinical assistance. At least part of this confusion seems to be due to the expectation that, since new terms are being used, new clinical techniques should differ radically from the old ones. The basic intent of this paper is to show that adopting a phonological approach to dealing with speech sound disorders does not necessitate a rejection of the well-established prinicples underlying traditional approaches to articulation disorders. To the contrary, articulation must be recognized as a critical aspect of speech sound development under any theory. Consequently, phonological principles should be viewed as adding new dimensions and a new perspective to an old problem, not simply as refuting established principles. These new principles have resulted in the development of several procedures that differ in many respects from old procedures, yet are highly similar in others. Whether phonological approaches are better than existing procedures remains an important, but unanswered question.*

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It has been almost a decade since Ingram's (1976) seminal work on phonological disorders in children; yet, in my interactions with clinicians across Canada and the United States, I still find that the notion of phonology and its role in Speech

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Pathology is a source not just of debate, but of bewilderment. A common misconception is that adoption of phonological principles into clinical procedures somehow necessitates a refutation of principles of articulation that have formed the basis for our assessment and therapy approaches in the past. In this paper, I hope to clarify this and several other conceptual problems confronting clinicians who work with phonologically disordered children. I will begin by explaining my preference for the term "phonological disorder" over the more traditional term "articulation disorder". From this point, I will proceed to show how principles from theories of phonological acquisition have been applied to assessment and intervention with phonologically disordered children. It will be shown that these applications yield results that are sometimes significantly different from "traditional" procedures and other highly similar.

## Phonological Disorders or Articulation Disorders: An Exercise in Semantics?

To begin this discussion, some definition of terms is in order. *Articulation* may be viewed as the processes involved in the planning and execution of smooth sequences of highly overlapping gestures of the speech organs. These gestures are mapped onto an airstream such that the output of these processes is a continuous stream of acoustic signals recognized as speech.

If this definition can be accepted without too much disagreement, then two important implications seem to follow. First, articulation learning must involve the acquisition of the ability to move the articulators in the rapid and precise manner demanded by the language. Stated another way, articulation learning is a specific type of motor learning. Second, errors in articulation (misarticulations) must be seen as disruptions at some level of the relatively peripheral *articulatory processes*. When a

child is said to have misarticulated /s/, this suggests to me that the child tried to produce the voiceless, alveolar fricative of English, and her articulatory system failed in its precise execution of this target. It says nothing to me of the possibility that the child may not have known the correct articulatory target in the first place; that is, the possiblility that the child has correctly articulated the wrong target sound seems not to have been considered.

Some readers may note that this objection to the term "articulation disorder" is semantic, being based on a fairly literal interpretation of "articulation". While I agree that this is true, this semantic objection is not insignificant. Some therapy procedures are based almost exclusively on the notion that speech sound errors are due to faulty control of the articulators. With this as a basic theoretical assumption, it follows that facilitation of articulatory speed, mobility, and precision represent the most logical means of remediation (e.g., McCabe and Bradley, 1975; McDonald, 1964; Scripture and Jackson, 1927; Stinchfield-Hawk and Young, 1938). These procedures have served us well, and it is likely that they will continue to do so. They are inadequate, however, in those cases where errors result from factors other than articulation.

It can be argued that a listening component should be added to this basic articulatory account, since some practitioners have traditionally used techniques such as "ear training" (Van Riper, 1963) to improve discrimination skills. In fact, Van Riper comes very close to a cognitive account of what has to be done in therapy when he claims that

He (the child, MEF) must come to *know the characteristic features* of this new target sound...In this necessary perceptual defining of a standard pattern, the ear training period, we do not ask the child to attempt the new sound. Not yet. First let us be sure that he *internalizes the model" (p. 249, my emphasis).*

According to Van Riper, successful ear training is useful for all children with speech problems, and it often leads to the child's ability to produce the sound in isolation with no further cueing. I am not at all comfortable invoking the term "error of articulation" to describe errors that result from "mishearing", but, again, this seems to be a semantic objection. If we assume that what Van Riper (1963) meant by "articulation" is a sensory-motor skill, involving both listening and speaking, the meaning of articulation may get stretched considerably, but the substantive claims of his clinical position remain intact. The child's task is to listen to sounds produced by

competent speakers and match that production with output of her own. Errors may occur for two reasons. Either the child fails to discriminate one sound from another (e.g., she may hear [k] as /t/) or she discriminates correctly, and her articulatory system falls short of its mark.

The basic unit of analysis in most of these "traditional" approaches is the phoneme, and errors are generally viewed as omissions, substitutions, distortions, or additions on a phoneme-by-phoneme basis. It is interesting to me that despite the strictly linguistic nature of the concept "phoneme", no mention is made at any level of analysis of the role that language may play as a source of error or as a source of motivation in children's development of speech. The fact that phonemes function to contrast meanings seems to have been overlooked. (The clinical approach of Backus and Beasley (1951) is an exception to this general failure to recognize the importance of sound production to meaning and communication.)

*Phonology* is a much broader concept than "articulation" that refers to the language component that governs the manner in which speech sounds are patterned. It involves the repertoire of *phonemes* that are found in the language; that is, those sounds that function in the language to signal a change in meaning. It also involves the alternations that phonemes undergo when they occur in different phonetic contexts (e.g., voiceless stops in English are aspirated when they initiate a syllable [kʰ æ t], but are unaspirated following /s/, [sk⁼ æ t], and may not be released at all in phrase-final position [tʰ æ k⁷]. The combinations of sounds that may occur in the language and the possible shapes for syllables and words are prescribed by the *phonotactic constraints* of the language (e.g., words beginning with /ŋ/ are not admissible in English). Phonologists are also interested in the way different phonemes group together by virtue of the way they function in the operation of (morpho)phonological rules. For example, in English, sibilants form a *natural class* of phonemes because sibilants, and only sibilants, are followed by /əz/ to form plural, possessive, and third person present singular inflections, e.g. "bunches", "buses", "buzzes", "bushes", etc. From the perspective of developmental phonologists, the child must learn each of these aspects of the sound system, of which articulation is only a part. Thus, the articulation-based account seems not to be broad enough in scope to describe all that must be learned.

Another real problem with our embellished sensory-motor account is that it describes errors as emanating from only two sources, listening and

articulating, when there is a good deal of evidence that some errors occur at central rather than peripheral levels. To my way of thinking, the strongest such evidence comes in the form of "puzzles". This phenomenon was reported by Smith (1973) in the speech of his son, Amahl. Puzzles occur when the child produces a sound correctly in contexts where it does not belong and consistently misproduces it when it is required. For example, Amahl produced "puzzle" incorrectly as [pʌdəl], but pronounced "puddle" as [pʌgəl]. It is not likely that faulty articulation can account for this type of error, since the errors are often highly consistent, and the child demonstrates quite clearly that the correct pronunciation is well within the capabilities of the articulatory system.

These types of examples are not uncommon among phonologically disordered children. For example, Pollack and Rees (1972) briefly mentioned a case of a four-year-old girl who lateralized attempts to produce [s] but produced a perfectly acceptable [s] in her production of target words containing [f]. We observed a 4-½-year-old girl who produced [h] for all intervocalic alveolar and dental continuants, but substituted [s] for [ʃ] and [tʃ] in the same positions. Thus, "mashing" was pronounced [mæsɪŋ] and "passing" was realized as [pæhɪŋ]. These puzzles and "near puzzles" defy explanation as peripheral errors, especially when it can be shown that the child has no difficulty perceiving the difference between her error sound and the target, as was the case in the last example given above.

A second type of evidence that is not readily explainable within traditional articulation approaches lies in the idiosyncratic patterns found in the speech of some normally developing and some phonologically disordered children. For example, Fey and Gandour (1982) presented data from a normally developing child who produced word-final voiceless stops correctly, but produced word-final voiced stops as oral stops released with nasal plosion (e.g., "back"→ [bæk] and "big" [bɪgŋ]). If all the child is trying to do in speech sound learning is match articulatory output with adult input, this example seems rather anomalous. After all, this child's production added a syllabic nasal to the target, with the result being auditorily quite distinct from the adult model. Further, he had no perceptual difficulties involving word-final oral and nasal stops. Gandour and I argued that this unusual pattern developed as a result of competing linguistic and articulatory forces. The child seemed to want to preserve the *phonological contrast* between voiced and voiceless stops in the final position of words. At that time,

however, he lacked the articulatory control to produce this distinction in the same manner as adults. Therefore, he adopted a rule, which we called postnasalization, that enabled him to maintain the phonological distinction in a way that was consistent with the constraints of his existing sound system, but which yielded phonetic output that was different from the adult target. Importantly, the consistency of his productions led us to believe that his errors were not articulatory in the sense described above, but that his phonetic target had been modified internally, and he was reaching this new target with great automaticity and precision.

Two things seem manifest at this point. First, the child must learn more than just a set of complex articulatory patterns associated with words. She must learn a complete phonology. Second, observation of the patterns found in young children's speech suggest that discrimination and articulation are not the only sources of learning or of error in children's speech. For these and other reasons, child phonologists have proposed that some central, cognitive-phonological processing must be included in any description of phonological acquisition and that at least some of the errors made by children are due to difficulties at this level.

For my present purposes, it is not necessary to go into any detailed discussion of the various theories of phonological acquisition that have been proposed. A very thorough and up-to-date discussion can be found in Edwards and Shriberg (1983). Some clarification of the terms *phonological process* and *phonological rule* may be needed, however. Edwards and Shriberg (1983) define a phonological process as "any systematic sound change that affects a class of sounds (e.g., velars, fricatives) or a sound sequence, such as /s/ plus sonorant clusters (/sw, sl/, etc.)" (pp. 33-34). This definition appears to be synonymous with the term *invented rule*, used by Kiparsky and Menn (1977). I will use "rule" rather than "process" to avoid confusion with "natural phonological processes" as described by Stampe (1973) and the theoretical baggage that this latter term carries with it.

Though there are marked differences in the ways in which different theorists actually write these rules and in the nature of the underlying systems from which the rules presumably arise, there is considerable agreement that a child phonology rule involves the child's modification of the adult target form to a form that is, for reasons that are not always clear, more manageable for the child. This modification takes place internally, not peripherally, so that

the actual articulatory gestures required have been in some way simplified. Thus, *stopping* is a rule that changes fricative targets to stop targets (e.g., "soup" → [tup]). *Weak syllable deletion* has the effect of deleting syllables that are weakly stressed in words of a particular length, say, greater than two syllables (e.g., "banana" → [naenə]. *Assimilatory* rules function to make certain sounds in a word more like other sounds (e.g., "dog" → [gɔg]), and so on.

In sum, I believe that the term "phonological disorder" is preferable to "articulation disorder" for the following reasons. First, the term better captures the essence of what must be learned, the phonology of the language, rather than just the control over the gestures required for rapid, precise articulation. Second, phonological accounts make explicit the fact that children's errors are often not sound- or word-specific, but seem to spread over groups of sounds that are similar in the phonological features of which they are composed. Third, a deficit in phonological acquisition implies potential difficulties at several different levels including discrimination of phonetic differences (e.g., + aspiration versus - aspiration), recognition of phonological contrasts and representation of those contrasts in the lexicon (e.g., + voice versus - voice), modification of speech sound targets through the use of child phonology rules, and articulatory imprecision as well as other possible levels that I have not specifically addressed. Fourth, acceptance of phonological principles places a burden on the clinician to assess and treat her clients in ways that are not easily rationalized within other theoretical frameworks. In contrast, the traditional articulatory positions seem to predict difficulties only in articulation, or, using a looser interpretation of "articulation", in articulation and/or speech sound discrimination. Therefore, there is no motivation for the clinician to look for more general organizational principles underlying the child's difficulties.

I must re-emphasize the fact that many phonological approaches to speech sound learning are explicit in their recognition that the difficulties inherent in the articulation of certain classes of sounds (e.g., sibilants) along with the limitations of the young child's developing vocal tract are important factors in the child's use of child phonology rules. Thus, articulation and phonology are highly interdependent constructs; the child who cannot articulate the sounds of the language being learned will, necessarily, develop a phonology that differs in important ways from the adult phonology. For example, the cleft palate child who has no functional velar mobility is not likely to acquire distinctive articulatory features like "oral" and "nasal". Therefore, when

surgery makes adequate velo-pharyngeal closure possible, the child must not simply shake old habits to adopt a normal speech pattern, she must learn a new set of articulatory features that are more like those of adults. It should be clear that my preference for the term "phonological disorder" reflects a claim that several factors other than articulation and discrimination are important in phonological acquisition; it does not suggest a rejection of the assertion that articulation is an important link in the overall process. I am in complete agreement with Kent (1983), who stated that

> To study speech merely as a pattern of muscle contractions related to an observed movement sequence (as might be profitably applied to the study of locomotion) is as short-sighted as the complementary error of studying speech as a transparent expressive mode for any given linguistic theory. Speech has to be recognized as a motor skill but also as a mode of language expression (p. 86).

### Implications of Phonology for Speech Assessment

Regardless of the particular theoretical framework within which the clinician is working, an assessment of an individual's phonology will almost certainly include procedures designed to answer the following basic questions.

1. What sounds does the child produce, whether or not they are used correctly? This question of the child's *phonetic repertoire* really involves the child's articulatory skills and may require not only careful analysis of spontaneous speech samples, but also traditional articulation testing and subsequent stimulability testing.
2. What syllable shapes does the child produce? An analysis of the syllabic and lexical shapes found in the child's speech may indicate that the child is using a particular acquisition strategy such as focusing on sound contrasts at the end of the word while erring on sounds at the beginning. It will also help identify any strong phonotactic constraints that seem to be limiting the child's productions.
3. What phonological contrasts are present in the child's spontaneous speech output? For this assessment of the child's *phonemic repertoire,* emphasis is on contrast, not on correctness. For example, a child may make a distinction between fricative and non-fricative sounds in an unorthodox way, e.g., by substituting the affricate [ts] for all and only fricative sounds.
4. When the child has failed to preserve contrasts in her speech output, what factors seem to be

involved? The information gleaned from answering the questions above may give some indication as to the level at which the child's problems are occurring, i.e., perceptual, organizational or articulatory. Often, it is helpful to test the child's ability to recognize the linguistic importance of a sound contrast through the use of the perceptual tasks of Locke (1980) or similar procedures. In these tasks, the child must compare spoken forms (e.g., [kar] and [tar]) with her own internal representations of those forms. This type of testing may indicate that the child mentally stores [k] and [t] in an identical fashion (e.g., /t/) and does not articulate a difference between the two because the audible difference between them is not perceived as being important to meaning.

5. What phonological rules are active in the child's system? Although a perceptive clinician working from a traditional articulation-based persepctive may detect certain error patterns, only phonologically-based accounts regard the presence of such patterns as being highly significant. Therefore, only clinicians working within a phonological framework have a set of procedures designed specifically for detecting these patterns (Hodson, 1980; Ingram, 1981; Shriberg and Kwiatkowski, 1980; Weiner, 1979).

Failure to adopt a general approach to assessment such as that briefly outlined above results in a number of characteristic problems. First, patterns of error and their generality across the child's system typically are not discovered. This is especially true of assimilatory and syllable-structure rules. Second, when relevant patterns are not discerned, the observed errors often simply appear to be anomalies. The "inconsistent" phonemic errors that result especially from assimilatory rules and syllable structure rules present special problems for determining whether a given sound will require therapy. For example, the child's accuracy rate for a given sound may vary predictably, depending on the extent to which stimuli that involve assimilation are sampled. If the sample contains several words for which the conditions for assimilation are met, several errors will occur on sounds that otherwise might be produced flawlessly. Third, the recommendations for therapy are likely to be limited to some form of articulatory drill or discrimination training involving only one or a small number of phonemes, even when evidence exists that the sound is easily produced by the child and that she has no difficulty discriminating between her own production and the adult target.

To illustrate these claims more clearly, several of the responses of a 5 year, 11 month-old boy, Aaron, to the stimuli from The Assessment of Phonological Processes (Hodson, 1980) are included in Table 1. Aaron was of normal non-verbal intelligence as determined by the Test of Non-Verbal Intelligence (Brown, Sherbenou, & Dollar, 1983), and he had no signs of active oral peripheral pathology.

Table 1. Aaron's productions of fricatives and affricates in consonant clusters and as singletons as well as all words containing the environment for regressive nasal assimilation from *The Assessment of Phonological Processes (Hodson, 1980).*

### Fricatives and Affricates in Clusters

| | | | |
|---|---|---|---|
| basket | [dæekit] | chair | [tsɔ] |
| crayons | [nə | father | [tsɔə] |
| three | [tsi] | fish | [tsɪts] |
| flower | [naᴡɔ] | fork | [tak] |
| horse | [hɔts] | glasses | [tsatsɪ] |
| ice cubes | [aɪstub] | glove | [tsɔts] |
| mask | [mæets] | leaf | [li] |
| music box | [mugikbak] | mouth | [mau] |
| screwdriver | [tutsæva] | music box | [mugikbak] |
| sleigh | [tseɪ] | nose | [nou] |
| smooth | [mju] | page | [paɪts] |
| snake | [neɪk] | rouge | [luts] |
| spoon | [nju] | Santa Claus | [næenkɔ] |
| spring | [niŋ] | screwdriver | [tutsæva] |
| squirrel | [kʌᴡə] | shoe | [tsu] |
| star | [tsaə] | smooth | [mju] |
| sweater | [saᴡɔ] | soap | [tsoup] |
| toothbrush | [tᴜˈbɔt] | TV | [tsitsi] |

### Fricatives and Affricates as Singletons

| | |
|---|---|
| that | [æt] |
| thumb | [tsʌm] |
| toothbrush | [tubət] |
| vase | [beɪts] |
| watch | [tsa] |
| zipper | [tsɪpɔ] |

## Words Containing the Phonetic Environment for Nasal Assimilation

| | | | |
|---|---|---|---|
| airplane | [oᵤni] | Santa Claus | [nænkɔ] |
| crayons | [nɔn] | spoon | [nju] |
| candle | [nænə] | spring | [niŋ] |
| green | [ni] | string | [nin] |
| gun | [nɔn] | thumb | [tsʌm] |
| hanger | [hæŋɔ] | | |

These results demonstrate the significant degree of difficulty that Aaron had with fricatives and affricates. Of the 47 instances on this test where a fricative or affricate was required, 19, or 40% were omitted. Omissions were associated primarily with the many consonant clusters required on this test, as well as word-final productions. Further analysis of these omissions is interesting, but not necessary for this discussion. More importantly, 22 fricatives or affricates, or 79% of the remaining, non-omitted attempts, were realized in his phonetic output by the strident affricate, [ts], which is not even an English sound. Three of the four instances in this sample where [ts] was used for some sound other than a fricative or affricate ("glasses", "gloves", "screwdriver", and "TV") can be viewed as cases of regressive assimilation. This argument is strengthened by the fact that Aaron had a very strong regressive nasal assimilation rule that applied in 9/11 possible instances on this test. In other words, the tendency to assimilate is demonstrated in other parts of his phonology as well as in his use of [ts]. Although instances of the use of [ts] for non-fricative targets (e.g., "tub" = [ts ʌ b] occurred in Aaron's spontaneous speech, these cases were exceptional.

The interpretations of these data of a clinician working from a phonological perspective would differ significantly from one operating within a more articulation-based framework. For the phonologist, Aaron would be viewed as having a preference for [ts], which he then uses as a means to distinguish between fricative-affricate and other sounds in his phonetic output. He also has a very strong pattern of nasal assimilation and a weaker pattern of "[ts]-assimilation" operating in his system. These patterns of error, along with some others not mentioned, combine to render A's speech virtually completely unintelligible. I do not think that the three patterns identified would be at all obvious to someone not working from a phonological orienta-

tion, and even if they were, they would simply be regarded as anomalies, not as general patterns which might themselves be amenable to intervention. The traditional account, I believe, would simply indicate that some very strange errors occurred on the following sounds: /f v θð s z ʃ ʒ tʃ dʒ/ and that errors were "inconsistent" on each of the sounds influenced by nasal or [ts]-assimilation. In other words, each error would be regarded as a separate problem and would be treated as such in therapy.

## Some Problems With Phonological Assessment Procedures

At this point, I must note some of what I believe to be some significant problems with phonologically-oriented approaches to assessment. First, there is very little agreement as to which distinctive feature system, if any, should be used to describe error patterns. For example, McReynolds and Engmann (1975) use Chomsky and Halle (1968) features. Blache (1982) uses features fashioned after Jakobson, Fant, and Halle (1969), and Singh, Hayden, and Toombs (1981) use features proposed by Singh (1976). Walsh (1975) and Parker (1976) have pointed out some of the basic problems inherent in adopting any binary feature system that categorizes classes of sounds at an abstract level of representation, when the objective is to modify the child's phonetic output. Though it is possible to describe children's patterns in ways that do not require adoption of a set of distinctive features (Ingram, 1976; Shriberg and Kwiatkowski, 1980), some of the elegance of the resulting descriptions is often lost in doing so.

Second, phonological rules are often written with little evidence as to what the child's underlying representation actually is. Since it is proposed that the child is systematically changing sounds at a central, rather than a peripheral level, it is important to state what the child is actually assumed to know at

the underlying levels. In some accounts (e.g., Smith, 1973, Stampe, 1973), the child is assumed to have all of the articulatory features characteristic of the adult target stored at an abstract level of representation. In other proposals (e.g., Braine, 1976), the child is assumed to store auditorily-based features that may reflect a collapse of adult phonemic categories. Thus, errors may be made at a perceptual level or at the level in which abstract articulation-based features are mapped onto underlying auditory representations. In either case, certain assumptions about the child's knowledge at underlying levels of mental representation are often made but rarely verified. Unfortunately, as Locke (1983) has pointed out, determination of the level at which the problem is occurring is often difficult, if not impossible.

The third problem, which is highly related to the second, is that two or more rules often seem to be operating on the same sound in some ordered fashion; if /m/ is changed to [p] for example, two rules, denasalizaiton and final consonant devoicing, could conceivably be operating. Unfortunately, decisions regarding which rules are in effect, and in which order, often must be made intuitively, unless extremely large samples of data are examined to provide independent corroboration for each of the proposed rules. In the example above, the clinician would need to look for evidence for both denasalization and final consonant deletion operating independently of one another elsewhere in the sample to satisfy this requirement and to avoid arbitrariness. Shriberg and Kwiatkowski (1980) are especially sensitive to this problem. They propose a general principle that only one sound change may be recognized per sound as well as a prescribed order for analyzing processes. If these two guidelines are followed, the problem can be avoided. However, although these methods ensure inter-clinician reliability, they may, at times, overlook clinically important details about the child's system.

Fourth, there is no non-arbitrary way to determine how consistently and how generally a child phonology rule must apply before it can be viewed as clinically significant. Elbert and McReynolds (1981) suggested that before a rule could be viewed as operative in a child's system, an error should occur on a least 25% of the words on which the rule was predicted to operate, and at least four words meeting the conditions of the rule must occur in the sample. Khan and Lewis (1983. adopted 33% as their cutoff value, and Hodson and Paden (1983. suggest that rules that occur in 40% of their obligatory contexts on Hodson's (1980. *Assessment of Phonological Processes* should be targeted for intervention.

Fifth, some phonological rules, such as velar fronting and gliding (or liquid simplification), never influence more than two or three sounds. For example, since English contains only three velar consonants, calling an error pattern "fronting" often provides little advantage over traditional interpretations. For example, working on the basis of phonetic rather than phonological principles, Elbert, Shelton, and Arndt (1967) predicted and observed that training of a voiceless consonant, /s/, resulted in improvements on its voiced cognate /z/, but not /r/. Thus, even before "fronting" became a part of the Speech Pathologist's jargonistic repertoire, it was known that training on /k/ was likely to result in improvements on /g/ and, perhaps, /ŋ/. This lack of generality is not inherent in all observed child phonological rules, but this example illustrates that, at least in some cases, we have simply adopted new terms for already well-established principles.

Finally, as Locke (1983) has pointed out, calling a pattern a phonological rule or process is only a descriptive exercise. The existence of the pattern does not necessarily explain anything; the pattern itself is in need of explanation. It is true that some rules such as assimilations, stopping, final consonant devoicing, etc. seem to reflect a change from a more articulatorily complex pattern to a less complex pattern. However, this fact does not explain why some children develop these patterns and then abandon them naturally and without overt teaching, whereas other children persist in their use of these patterns and fail to develop, without considerable guidance, the sound pattern of the adult language. We must be cautious that we do not stop our search for causal explanations of disorders simply because we have some elegant descriptive principles and terms that can be used to organize and label them.

### Implications of Phonology for Treatment

There are three basic principles that seem both to underly most phonology-based approaches to treatment and to be unique to these approaches (e.g., Blache, Parsons, & Humphreys, 1981; Costello and Onstine, 1976; Ferrier & Davis, 1973; Fokes, 1982; Hodson & Paden, 1983; McReynolds & Bennet, 1972; McReynolds & Huston, 1971; Pollack and Rees, 1972; Singh and Polen, 1972; Weiner, 1981). First, all such programs focus on the modification of groups of sounds that seem to be treated by the child in a similar fashion, i.e. errors are attacked at the feature or rule level, rather than at the phonemic level. Second, emphasis frequently is taken off of correct sound production and is placed on the establishment of previously neutralized phonological contrasts. For example, the child who

replaces all fricatives with stops may receive a positive response from the clinician when *any* fricative is used, even if place of articulation or voicing errors persist. It is true that some traditional approaches have made use of successive approximation (e.g., Van Riper, 1963), but this is always an intermediate step to reaching an isolated phonetic target. In the phonological approach, the goal can be conceived as establishing and maintaining new contrasts, such as stop/fricative in the example given above. With such a goal in mind, correct production is not essential. Third, there is much greater emphasis on the use of speech sounds for communicative purposes, rather than on the correct production of sounds as a goal in itself.

The manner in which therapy is organized, especially with respect to goal selection, operationalization of a "correct response", and stimulus collection and organization, is distinctly different from more traditional "articulation therapy" approaches. This is made especially clear in the program for treating unintelligible children proposed by Hodson and Paden (1983). This procedure derives its phonological "flavour" from its emphasis on groups of sounds affected by phonological rules and in its almost revolutionary principle of "cycles". For each error pattern, several, but not all, affected sounds are treated in a sound-by-sound manner using several familiar techniques mentioned below. Importantly, each sound is practiced for only about a week before moving to another sound within the error pattern, i.e., no criterion for advancement to a new sound is required or used. In each cycle, all of the child's error patterns are treated by working on representative sounds in this manner. After all error patterns have been treated, a new cycle begins and involves work on all old patterns that have not yet been modified by the child. Several cycles are typically required before an unintelligible child is intelligible and exhibits only residual speech sound errors. I do not believe that such a radically different approach to treatment would be proposed if the authors had not accepted the notions that children who acquire phonology normally do so only gradually, at least partially because of the cognitive aspects of the task at hand. It takes time for the child to work out all of the significant problems that acquisition of the adult phonology presents.

In contrast to the differences between phonological and traditional approaches in their organizational characteristics, the actual procedures used to reach phonology-based goals, are often very similar to existing porcedures, and they often retain a surprisingly peripheral character. For example, Hodson and Paden's (1983) procedure makes use of techniques such as "auditory bombardment", "tactile stimulation", including moto-kinesthetic techniques, "visual stimulation", including phonetic placement techniques, and production practice. Weiner (1979) has suggested that procedures such as Weston and Irwin's (1971) paired stimuli approach may be effective in modifying children's assimilation rules. These are the very techniques that have been used traditionally by "articulation therapists".

I believe that there is only one therapy procedure that embodies all of the three principles mentioned at the beginning of this section and that is truly different from procedures emanating from an articulation or discrimination framework. This procedure has a number of different faces (cf. Blache, 1982; Blache & Parsons, 1980; Blache, Parsons, & Humphreys, 1981; Ferrier & Davis, 1973; Fokes, 1982; Weiner & Ostrowski, 1979; Weiner, 1981) but has as its basic underlying principles the notion of "minimal contrast" and the functional use of speech to transmit unambiguous messages. The most familiar version of the procedure involves collecting sets of pictures representing minimal contrasts that are neutralized in the child's speech. For example, if the child has a stopping rule, four relevant pairs might be, "fig"-"pig", "thin"-"tin", "sick"-"tick", "shop"-"top". Several pictures for each word are needed. Each pair is worked on separately. The child's task is to collect all of the pictures of words containing the target feature, e.g., "fig". What typically happens is that the child uses her old error pattern initially. The clinician then provides the child with the picture of the word containing the error sound, e.g., "pig". Thus, a communication problem is set up which is resolvable only by the child's active exploration of her vocal tract to find an acceptable alternative to the old means of producing the word. As soon as any fricative is produced, the child receives the picture she was actually requesting. Thus, she is reinforced not just for correct sound production, but for exploring the sound-making potential of her vocal tract and for communicating in an explicit fashion.

Even in the minimal contrast procedure, however, the clinician must often resort to the use of placement cues, frequent auditory models, hands-on manipulation of the articulators, etc. The need for resorting to phonetic cues is not unexpected in a cognitive, developmental approach, since the development of articulatory skill is a recognized factor in models of phonological acquisition. However, Shelton (1982) noted that the effectiveness of this procedure may not require a cognitive-linguistic explanation because phonetic models and cues are also present. Further, Hodson and Paden (1983)

expressed concern that some children seem unable to locate a closer approximation to the target using this procedure and, therefore, become unduly frustrated. They suggest that for unintelligible children, the task often may be contraindicated.

## Conclusion

I am presently strongly committed to phonological approaches to speech assessment and intervention, primarily because I believe that the adoption of phonological principles has led to a new set of hypotheses and predictions about the ways in which children develop their speech sound systems. These same hypotheses and predictions have been useful in designing promising new approaches to assessment and intervention with phonologically disordered children. It should not be surprising that these new approaches contain elements of older, well-established techniques. To expect techniques based on models of phonology acquisition to differ radically from existing procedures suggests that many of the principles of existing models have been cast aside in favor of radically different ones. I do not believe this to be the case. To learn phonology, the child at the very least must hear sounds and articulate them, and no theory or clinical approach that does not take these factors into account can be considered seriously. Whether new phonological approaches add dimensions that make therapy significantly more effective than existing techniques has not been demonstrated and, to the best of my knowledge has not ever been tested experimentally. The question is an empirical one, however, and its answer must be pursued vigorously.

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